TRI-STATE GENERATION AND TRANSMISSION ASSOCIATION, INC.
HEADQUARTERS: P.O. BOX 33695 DENVER, COLORADO 80233-0695 303-452-6111

July 9, 2020

Mrs. Janet Binns
Environmental Protection Specialist
Colorado Division of Reclamation, Mining and Safety
1313 Sherman Street, Room 215
Denver, CO 80203

RE: New Horizon Mine (Permit No. C-1981-008)
Technical Revision No. 9 (TR-99)
Pond 013 Limestone Inlet

Dear Mrs. Binns:

Tri-State Generation and Transmission Association Inc. (Tri-State), is the parent company to Elk Ridge Mining and Reclamation, LCC (ERMR), which owns and operates New Horizon Mine. The New Horizon Mine operates under the Division of Reclamation, Mining and Safety (DRMS) Permit No. C-1981-008. Tri-State received the Division's adequacy letter for TR-99 dated June 19, 2020 and has the following responses to the Division's concerns:

Table of Contents

1. *Page 1 in the Table of Contents (TOC), the current version has "i" not "1" in the footer. Pagination should remain consistent to minimize confusion.*

   Response: It is unclear where the Division is obtaining the pages number cited. Section 2.05.3(3) in the currently approved version (approved under TR-98), nor TR-99 contained the pages numbers cited for the Table of Contents. Moreover, please see response to comment 2 below.

2. Page 2 in the TOC, the current version has "ii" not "2" in the footer. Also, several tables, attachments, and maps are deleted from the TOC, however this is not reflected in the pages in the text. Please assure that the revised table of contents are also in agreement with previous revisions. For example; TR98 proposed to approve Table 2.05.3(3)-1 remunerated to page 10.

Response: The approved TR-98 materials, now the currently approved permit materials, have been incorporated into TR-99. To ease any potential issues with this incorporation into TR-99, the entire Section 2.05.3(3) has been resubmitted.

Text of Section 2.05.3(3)

3. TR99 Section 2.05.3(3) page 9 (March 2020) should be renumbered "Section 2.05.3(3) page 3" to fit in to the revisions approved with TR98 (AP 6/4/2020)

Response: Please see response to comment 2 above.

Deleted Attachments

4. Please explain why this revision proposes deletion of Attachments 2.05.3(3)-6 and 2.05.3(3)-21.? Should some of these attachments remain? For example, the safety calculations by Lambert Geotechnical engineers are not duplicated in Attachment 2.05.3(3)-32 and appear to be relevant to the pond specifications.

Response: Attachment 2.05.3(3)-6 and 2.05.3(3)-21, have outdated information that is not current with conditions of Pond 013 and the watershed contributing to it. There is zero justification for a permit document to contain three hydrology models for one sediment pond that puts Tri-State at risk of receiving a notice of violation due to duplication of materials in the permit. This risk is easily avoided by removing the outdated information. Further, duplicate information in a permit also places the Division in a position to not be able to understand what is current on the ground, and enforce rules when multiple iterations of a pond hydrology are presented in a permit document. Therefore, it is fully appropriate to remove both of these attachments and consolidate all of the Pond 013 hydrology into one location (Attachment 2.05.3(3)-32).

That being said, Tri-State does agrees with the Division that several items from Attachment 2.05.3(3)-21 should remain in the permit document. The Pond 013 embankment compaction results and the safety calculations have been inserted into Attachment 2.05.3(3)-32 accordingly.

Attachment 2.05.3(3)-32

5. Please explain why Tri-State decided to no longer reference Table 2.05.3(3)-1A (SCS Curve Numbers) on page 1 of the attachment, but instead references historical curve numbers in another table.

Response: Please see response to comment 2. This issue has been corrected with the incorporation of the approved TR-98 items.

6. Please provide an explanation the large change in flow out of Structure #2, from 0.00 acre feet to 8.18 acre feet. (See page 4 in the proposed SEDCAD run for the 10-year storm.)

Response: While trying to determine why there was a change in the flow from Structure #2, it was discovered that the previously submitted and approved SEDCAD model had multiple errors and inconsistent networking between the 10-year and 25-year storm events. Tri-State requests that the Division disregard the old model due to multiple errors, and review the compliant SEDCAD model submitted under TR-99.

7. Regarding Ditch C-9, it appears that the left sideslope was entered incorrectly. Should it be 2:1? (See page 7 in the proposed SEDCAD run for the 10-year storm.)

Response: The typographically error for the left sideslope of the C-9 ditch has been corrected as noted, and the 10-year and 25-year hour storm event demonstrations have been resubmitted.

8. Regarding Page 10 in the SEDCAD run for the 10-year storm, please explain why the dead space increased to 20% from 0% with this submittal.

Response: SEDCAD defaults to 20% dead space as this is the recommended amount of dead space for a pond with and average width ratio of 2:1 at the principle spillway according to Dr. Richard Warner as described in the *SEDCAD 4 Design Manual and User Guide*. The default selection of 20% is more reflective of the actual Pond 013 width ratio, rather than 0%.

9. Regarding Page 11 in the SEDCAD run for the 10-year storm, please explain why the trap efficiency increased to 66% from 0% with this submittal.

Response: Please see response to comment 6.

10. Regarding Page 4 in the SEDCAD run for the 25-year storm, please explain why the total runoff volume out of structure #2 increased significantly while the peak discharge decreased significantly with this submittal.

Response: Please see response to comment 6.

Also enclosed please find revised materials for this adequacy response, and a change of index sheet to ease incorporation of these materials in to the permit. If you have any questions, please contact Tony Tennyson at (970) 824-1232 or ttennyson@tristategt.org.

Sincerely,

DocuSigned by:
Daniel Casiraro
B70D69F114324DE...

Daniel J. Casiraro
Senior Manager
Environmental Services

DJC:JSS:der

Enclosures

cc: Frank Ferris (via email)
Chris Gilbreath (via email)
Tony Tennyson (via email)
File: G474-11.3(21)b-4

CHANGE SHEET FOR PERMIT REVISIONS, TECHNICAL REVISION, AND MINOR REVISIONS

Mine Company Name: **New Horizon Mine**
Date: **July 9, 2020**

Permit Number: **C-1981-008**
Revision Description: **TR-99 Pond 013 Limestone**

Volume Number	Page, Map or other Permit Entry to be REMOVED	Page, Map or other Permit Entry to be ADDED	Description of Change
1			No changes
2			No changes
3			No changes
4			No changes
5	Section 2.05.3(3) Pages 1 through 17 (17 pages)	Section 2.05.3(3) Pages 1 through 17 (17 pages)	Section 2.05.3(3) has been updated with materials approved under TR-98.
7	Attachment 2.05.3(3)-32 Pages 3 and 4 (2 pages) and all SEDCAD output pages (25 pages)	Attachment 2.05.3(3)-32 Pages 3 through 23 (20 pages) and SEDCAD output pages (25 pages)	A citation has been inserted into Attachment 2.05.3(3)-32 under Pond Construction. Pond 013 embankment compaction and safety calculations have been inserted from Attachment 2.05.3(3)-21. Pond 013 hydrology has been updated in response to comments..
8			No changes
9			No changes
10			No changes

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LIST OF ATTACHMENTS

LIST OF MAPS

Mine Facilities

A. Introduction

This section contains a description of the structures to be used in connection with or to facilitate the surface coal mining and reclamation activities at the New Horizon Mine area described in Section 2.05.3.

B. Sediment and Water Control Facilities Plan

New Horizon Mine will use various types of structures to control the runoff from disturbed areas within the permit boundaries. In addition, surface mining activities will be planned and conducted to minimize disturbance of the prevailing hydrologic balance in both the mine plan and adjacent areas in order to prevent long-term adverse changes in the hydrologic balance.

Sediment control measures will include proper utilization of mining and reclamation methods and sediment control practices individually or in combination. Typically, this will include disturbing the smallest practicable area at any one time during ground disturbing activities. If rills and/or gullies of limited areal extent form which disrupts the approved post mining land use or the reestablishment of the vegetative cover they will be mitigated as soon as practical. Repairs will also be performed in accordance with Rule 4.15.7(5)(a), which means they will be limited to no more than five percent of the acreage initially revegetated during any one year. If a rill or gully feature is identified, New Horizon will utilize appropriate manpower and equipment depending on the ground conditions and the extent of the erosion. This shall include but is not limited to small track dozers, blades, and rubber tired farm tractors. Equipment will be utilized to repair the areas with a minimal footprint as possible.

Occurrence of excessive rills and gullies will result in implementation of the following plan. One of, or a combination of, the following options and corrective methods will be employed: If it is determined that the topography of the regraded area is such that drainage is concentrated in a particular area, then this area will be improved to accept the runoff. In areas where no natural armoring is present, the drainage bottom or channel will be reshaped, if needed. The channel bottom will be seeded, covered with erosion matting and seeded, or rocked. The method used will, of course, depend on site conditions. Continued observations will be made of this area for problems or necessary maintenance. On slopes where no swale or defined channel exists, regrading, or disking, or chisel plowing will be performed, depending on the extent of the erosion. Reseeding will then take place. In addition to the above, contour furrows in and above the erosion area may be constructed to trap and slow down the runoff. Straw dikes can also be used where appropriate to control runoff and promote revegetation.
If corrective measures described above fail, New Horizon proposes to observe and reevaluate the situation. A combination of the first two methods described or some variation therein will be

applied. These activities can include, but are not limited to, rock channels, contour furrows or laterals with rock or matting bottoms, V ditches made with the dozer or motor grader, and subsequent revegetation. Head cutting in channels will be controlled by a number of methods. If the area is at a point that concentrates runoff, the area will be improved to accept this runoff. This would include reshaping the channel and channel bottom, covering with erosion matting, seeding, or rocking. Inlet channel erosion will be controlled down to the average water level of the ponds. Remedial action on pond slopes will extend as far down the slopes as equipment access allows, which at a minimum will be below the level of the principal spillway of each pond. In other areas, depending on the extent of erosion and time of year, the area will be regraded, disked, and seeded as needed. Straw bales, erosion matting, or rock fill may also be used to stabilize the area.

Should an area need repaired that requires a more long term control method, New Horizon may employ additional measures including erosion control blankets, straw wattles, silt fences, silt fence like products, small riprap structures, mulches, small check dams, small rock structures including rock basket(s) to reduce runoff volume. If repairs are required, all areas that have been mitigated will be seeded with an appropriate approved seed mixture. Prior to any erosional mitigation work occurring, the surface landowner (unless it is New Horizon private property) will be contacted for their approval of the proposed remediation measures. If any of the above mentioned sediment control measures are employed, they will be used inside the primary sediment control systems or in conjunction with small area exemptions (SAE). All surface mining operations will be conducted to achieve the effluent limitations of 4.05.2(7) for all mixed drainage when it leaves the permit area. Sedimentation ponds, diversion ditches, or impoundments will be constructed before creating new disturbances, unless approved drainage diversions or other surface water control structures are installed.

C. Collection Ditches, Culverts and Diversion Design Parameters

All ditches were designed and constructed in accordance with the applicable regulations in 4.05.3. Diversions will be designed, constructed, and maintained in a manner which prevents additional contributions of suspended solids to stream flow and to runoff outside the permit area, to the extent possible, using the best technology currently available. Appropriate sediment control measures for these diversions may include, but not be limited to, maintenance of appropriate gradients, channel lining, revegetation, roughness structures, and detention basins. No diversion will be located so as to increase the potential for landslides. When no longer needed, each temporary diversion will be removed and the affected land regraded, topsoiled, and revegetated in accordance with 4.06, 4.14, and 4.15. If the temporary diversion was for an ephemeral stream, the channel will be reestablished to functionally blend with the undisturbed drainage above and below the area to be reclaimed. Diversion design will incorporate the following:

a. Most ditches will not need to be lined; however, any stretch of collection ditch which has a velocity above 5.5 feet per second will be lined. Channel linings, including channel riprap, will be designed using standard engineering practices to pass safely the design velocities. These velocities assume the typical silty loam soil conditions on site. If better conditions exist, the velocities will be allowed to increase without lining. If worse conditions exist, lining may be needed for lower velocities.

b. Freeboard will be a minimum of 0.3 feet. Protection will be provided for transition of flows and for critical areas such as swales and curves when excessive velocities are anticipated.
c. Excess excavated material not necessary for diversion channel geometry or regrading of the channel will be disposed of in accordance with 4.09.
d. Topsoil will be handled in compliance with 4.06.
e. Many of the ditches, culverts and diversions will be temporary. For these structures, peak flows will be designed for a minimum 10-year, 24-hour storm event of 2.0 inches. However, some of the ditches, culverts and diversions will be permanent. These structures have been designed using a 100-year, 24-hour storm event of 3.0 inches. These designs also satisfy Montrose County regulations.

As shown on Map 2.05.3(3)-1, the permit area contains many collection ditches and culverts, which are labeled as either temporary or permanent. Many of the culverts are needed to convey drainage from disturbed areas under roads to the downstream collection ditch or sediment pond.

D. Designs for All Ditches in the Permit Area

Designs for all ditches were accomplished in the following steps:

1. Using a 3D grid of the watershed, the actual area and average land slope was developed.
2. A long flow line was drawn from the top of each watershed to the bottom of the ditch.
3. Using the SCS Method provided within Carlson Software or SEDCAD, the time of concentration was developed for each watershed.
4. Using the Time of Concentration and a worst case curve number, the peak flow was also developed within Carlson Software or SEDCAD using the SCS graphical method.
5. Using the maximum velocities stated earlier, ditch slopes, depth and bottom width geometry were then calculated for the channels.

Designs for all culverts were done in a similar manner except that once the peak flows for the culvert watersheds were calculated, the standard FHA procedures were used to properly size the culvert. In order to standardize culverts, a few culvert sizes were selected for all situations although, in some cases, the culvert is over designed.

E. Sedimentation Ponds 009 through 018 Design Parameters

In accordance with Rule 4.05.2, Ponds 009 through 018 will be used to prevent, additional contributions of sediment to stream flow or runoff outside the permit area due to mining disturbance. The pond designs and or run-off calculations for the sedimentation ponds are shown below:

Pond	Attachment	Maps
Pond 009	Attachment 2.05.3(3)-5 Attachment 2.05.3(3)-30	Map 2.05.3(3)-5-1 Attachment 2.05.3(3)-30, Map 1
Pond 012	Attachment 2.05.3(3)-12 Attachment 2.05.3(3)-13 Attachment 2.05.3(3)-31	Map 2.05.3(3)-12-1 Map 2.05.3(3)-12-2 Map 2.05.3(3)-12-3 Map 2.05.3(3)-12-4 Attachment 2.05.3(3)-31, Map 1
Pond 013	Attachment 2.05.3(3)-32	Map 2.05.3(3)-32
Pond 015	Attachment 2.05.3(3)-22 Attachment 2.05.3(3)-24 Attachment 2.05.3(3)-33	Map 2.05.3(3)-15 Map 2.05.3(3)-19 Attachment 2.05.3(3)-33, Map 1
Pond 016	Attachment 2.05.3(3)-29 Attachment 2.05.3(3)-36	Attachment 2.05.3(3)-29, Map 1 Attachment 2.05.3(3)-29, Map 2 Map 2.05.3(3)-36
Pond 018	Attachment 2.05.3(3)-28 Attachment 2.05.3(3)-35	Attachment 2.05.3(3)-28, Map 1 Attachment 2.05.3(3)-28, Map 2 Attachment 2.05.3(3)-28, Map 3 Map 2.05.3(3)-35

Pond 013 will remain for some time after the reclamation of the surrounding land but will not be permanent. Map 2.05.3(3)-1 shows the locations of all ponds. The sedimentation ponds are designed, constructed and maintained as follows:

a. Ponds 009, 012, and 013 have been designed to contain the 25-year, 24-hour event with no discharge from the emergency spillway. Ponds 015, 016, and 018 have been designed for a 100-year, 24-hour event with no discharge.
b. The sedimentation ponds are designed to provide adequate sediment storage volume in compliance with the DRMS regulations. Actual designs are based on a minimum 3 year sediment volume based on USLE calculations. Actual construction may cut more volume below the dam level (incised storage) to lessen expensive cleanout during the operation.
c. The principal spillway design is typically an 18-24" diameter CMP or other pipe which will have a valve on the entrance (see as-built for specific sizes). This pipe will be stopped down in the inlet side to a 6" valve which will be controlled by a wheel on the pond

embankment. During normal conditions, the valve will be left slightly open to provide 24-hour detention time for each pond during the large events. This is accounted for as weep holes in the SEDCAD design runs. For Ponds 012 and 013, SEDCAD analysis has shown that the effluent from a slightly open valve still meets effluent requirements. For these ponds, the operator can decide to leave the valve cracked or shut as described above.

d. Appropriate combinations of principal and emergency spillways to safely contain or discharge the runoff from a 25-year, 24-hour or larger precipitation events, as required by the DRMS's regulations, will be installed. If a pond is designed to contain the runoff from a 25-year, 24-hour or larger event, an emergency spillway will still be installed.
e. Pond freeboard will be a minimum of 1.0 feet from the highest level of water allowed in the pond (or emergency spillway) to the top of dam.
f. The top of dam width will be at least 10 feet in all areas.
g. All ponds except Pond 018 will have a keyway cut along the entire width of the dam**.** This keyway will be filled with competent material and compacted to the same standards as the dam foundation.
h. All principal spillways will have 2 anti-seep collars installed within the dam which will be at least 2x the pipe diameter. All dam fill will be compacted around the anti-seep collars and principal spillway pipe to 90% of the maximum dry density of the fill material.
i. Attachment 2.05.3(3)-15 demonstrates that the given materials on site have been tested for suitability in constructing pond embankments and that the long term slope safety factors exceed 1.3 in all cases, given the pond design parameters outlined above and in the Attachment. For this reason, no individual slope stability analyses are presented for the ponds. The exception to this being Ponds 016 and 018 for which individual slope stability analyses have been provided.

Tables 2.05.3(3)-1 and 2.05.3(3)-2 list the values of CN and "k" for different soil and vegetation types. The tables have been revised to address new soils found in the area west of 2700 Road. The curve number (CN) and "k" factor for each of the ponds is determined as a weighted average. The undisturbed area curve number and "k" factor information is based on the soils and vegetation information found within Sections 2.04.9 and 2.04.10, respectively, of the New Horizon Mine permit application.

The pond volumes are calculated by first using the Curve Number and Runoff Routine within the Hydrology module of Carlson Software and then using the USLE sediment storage routine within the Hydrology module of Carlson Software. The LS factors for the USLE are determined from the 3D CAD grid model of the drainage areas for each pond. The water volume is determined from the weighted average CN for the watershed based on the worst case conditions over the life of the mine and the appropriate design storm rainfall. Curve numbers used are from 78 to 90 based on the existing conditions, level of disturbance and the hydrologic soil type of each watershed. Once the required volume of sediment and storm inflow is known, these two are combined to get the total required volume. Carlson Software or SEDCAD was then used to design ponds in each location which had the parameters described in the previous section. All ponds were designed to fully contain the 25-year, 24-hour event. Ponds 015, 016, and 018 are designed to contain the 100-year, 24-hour event.

Shown on the following two pages are the calculations used by Carlson Software or SEDCAD in determining typical pond volumes.

Universal Soil Loss Equation: Used by Carlson Software
==
Required User Input:
====================
Note: The following values are to be entered by the user for each area in the watershed. The method for obtaining these parameters is left to the user.
Rainfall Factor (R): Default = 50;
Erodability Factor (K): Default = 0.37
C Factor (C): Default = 0.5
P Factor (P): Default = 1.0

Geometric Information:
=======================
Area (sq units): Can be entered by the user or the program calculates the area of a user-selected closed polyline. The user also has the option to enter the area in different units.

Slope, S (%): Can be entered by the user or the program calculates the slope when the user selects an area from the screen.

Length (L): Can be entered by the user. If the user selects an area from the screen, the length is not calculated since the Gross Erosion is directly calculated.

Topographical Factor (Ls): Will be calculated from Length (L) and the Slope (S), only when these values are entered by the user directly, as against calculated by the program from the screen. In the second case, the value of Ls is calculated for individual grids and not for the entire area.

$$Ls = (L/72.6)^{m} * ((430*S^{2} + 30*S + 0.43)/(6.613))$$

where L and S are defined above and
m = 0.5 if S=>5%; = 0.3 if S<= 3% ; = 0.4 otherwise.

Gross Erosion, E (tons/acre/year): Calculated from the above defined parameters for each area defined. If the user selects an area from screen, E is calculated in each grid and the cumulative value is calculated.

E = R * K * Ls * C * P, where all the parameters are as defined above

Volume Calculations:
======================
Required User Input

Sediment Delivery Ratio (DR): Default = 0.37
Time Period, T (years): Time of analysis; typically the time of the storm event
Density of the sediment (D): The post-deposit density of the sediment
Runoff (I): Calculated from some other routine like Curve Number and Runoff

Total Erosion (E, tons/year) = Sum of (E * Area) for all the areas.
Total Yield (Y, tons/year) = E * DR
Sediment volume per year (Vs) = Y / Density
Total Sediment Volume = Vs * Time period
Runoff Volume = Runoff (I) * Total Area
Total Pond Volume = Runoff Volume + Total Sediment Volume

Pond 009 was excavated in the spring of 2002. Pond 012 was excavated in spring 2005. Ponds 011 and 013 were constructed in late 2007, while Pond 011 was reclaimed in Fall 2015. Pond 015 was constructed in 2011. Finally, Ponds 016 and 018 were constructed in late 2016. Accordingly, the values for Ponds 009, 012, 013, 015, 016, and 018 are as-built. All ponds except for Pond 018 will utilize a key cut into the dam and anti-seep collars on the principal spillway pipe as shown on the map. All dams will have a minimum combined slope of 5.0H:1.0V, with the exception of Pond 015, which was excavated near solid rock and the embankment side is steeper than 5H:1V.

Table 2.05.3(3)-1 Surface Hydrology Curve Numbers

	Hydrologic Condition	Curve Number
Mine Disturbed Areas:		
Newly Graded Areas[1]	Poor	83
Roads	N/A	85
Reclaimed Areas:		
Topsoiled and seeded[1]	Poor	83
Topsoil Stockpiles[1]	Poor	80
1-2 years revegetation[2]	Fair	74
3+ years revegetation[3]	Good	62

Source: Part 630 Hydrology, National Engineering Handbook, Chapter 9 (USDA/NSCS, July 2004)

1. Curve number based on an average of "Fallow, with Crop Residue, Poor Condition", Table 9-1, with 50% HSG A and 50% HSG B and conservatively revised upward.
2. Curve number based on an average of “Pasture or Range, Fair Condition”, Table 9-1, with 50% HSG A and 50% HSG B and conservatively revised upward.
3. Curve number based on an average of “Pasture or Range, Good Condition”, Table 9-1, with 50% HSG A and 50% HSG B conservatively revised upward.

Table 2.05.3(3)-2 Sediment Pond Design - Soils Information*

Soil Type or Area	Hydrologic Soil Group	"k" Factor
18/F-2	D	0.14
5810/2B-1	B	0.17
5810/7C-2	B	0.17
5810E/D-2	B	0.17
5810I/3B-2	B	0.17
5810I/7C-1	B	0.17
9904/D-1,2	D	0.22
9904/F-2	D	0.22
1E	D	0.30
1EW	D	0.24
20C	C	0.24
30C	C	0.31
70B	B	0.34
808	D	0.32
810	D	0.24
Reclaimed	C	0.25
Active Pit + Spoil Piles	C	0.21
Non-topsoiled Regraded Spoil	C	0.23
Topsoil Removed	D	0.32
98A	B	0.24
98B	D	0.10
98C	D	0.28
98D	C	0.32
98E	B	0.28
98F	B	0.34
98G	C	0.34
98H	C	0.28

This table was revised to include the soils 98A through 98H found in the amendment area. The values for the hydrologic soil type and the “k” factor were developed from the site specific soil survey and the help of the local SCS office in Montrose.

Source: Gary Wendt, Soil Scientist, Peabody Coal Company (September 15, 1986 and March 7, 1988).

Ponds 009, 012, 013, 015, 016, and 018 will be maintained until:

1. The disturbed areas are reclaimed and the vegetation success requirements of Section 2.05.4(2)(e), revegetation are met.

2. The untreated drainage from the disturbed area ceases to contribute additional suspended solids above natural conditions, and
3. The drainage leaving the pond meets applicable State and Federal water quality requirements, if any, for the receiving streams. The ponds will be removed when the appropriate sections of the regulations are satisfied.

When the ponds are removed, the affected land will be regraded and revegetated pursuant to the DRMS's regulations, Section 4.05.17 and the approved New Horizon Reclamation Plan.

Dam Classification Criteria

The dam classification criteria follow the guidelines of the USDA Soil Conservation Service Technical Release 60 regarding potential for loss of life and damage as a result of dam failure. This classification criterion is shown below.

- Class A: No realistic threat of damage to property or life in case of dam failure.
- Class B: Dams located in predominately rural or agricultural areas where failure may damage isolated homes, main highways or minor railroads or cause interruption of use or service of relatively important public utilities.
- Class C: Dams located where failure may cause loss of life, serious damage to homes, industrial and commercial buildings, important public utilities, main highways, or railroads.

Special demonstrations are needed for ponds that have Class B or C dams. It is demonstrated below that each of the ponds meets the Class A criteria.

Ponds 012 and 013 - As seen on Map 2.05.3(3)-1 Surface Hydrology, Ponds 012 and 013 are located immediately outside the floodplain of Tuttle Draw. Any dam break of these ponds would discharge water directly into Tuttle Draw. There is no chance the water could harm anything or anyone at other locations. There are no structures that could be affected by a small volume in Tuttle Draw since it is large enough to handle substantial peak flows, as shown on Map 2.05.3(3)-1. For these reasons, Ponds 012 and 013 are given a Class A designation.

Ponds 015, 016, and 018 - Since these ponds are designed to contain the flow from a 100-year, 24-hour event they would only contribute a couple acre-feet to a drainage from overflow or embankment failure. Thus, these ponds are given a Class A designation.

Stock Ponds - Prior to mining, a small stock pond existed on the Goforth property (see Map 2.04.9-1); therefore, a replacement stock pond (SP1) was constructed in the postmining surface. Another stock pond (SP2) will be constructed on ERMR property by backfilling and regrading a portion of Pond 009. Applicable technical information has been included in Attachment 2.05.3(3)-38 and -

39. These ponds should also have a Class A designation since their small capacity would pose no realistic threat of damage to property or life in case of dam failure.

F. Alternative Sediment Control Measures

Please see Attachments 2.05.3(3)-34 and 2.05.3(3)-37 for alternative sediment control measures utilized at New Horizon Mine.

G. Discharge Structures

Discharge from the sedimentation pond and diversions will be controlled by riprap channels and other means or devices where necessary to reduce erosion, to prevent deepening or enlargement of stream channels and to minimize disturbance of the hydrologic balance. Discharge structures will be designed according to standard engineering design procedures.

H. Lincoln Street Haul Road

The following describes the Lincoln Street Haul Road at the New Horizon Mine. Refer to Map 2.05.3(3)-8 for a plan view of road alignment, road profile and typical cross-sections. A portion of the road is located within 100 feet of the Montrose County road right-of-way. As required by DRMS, New Horizon requested a waiver from Montrose County to disturb within 100 feet of the County right-of-way. Montrose County has granted a waiver as a part of the Special Use Permit.

General Requirements

New Horizon will ensure that maintenance and postmining conditions of the Lincoln Street Haul Road will control or prevent erosion and siltation, pollution of air or water, and damage to public or private property in accordance with 4.03.1(1).

Design

The Lincoln Street Haul Road is an existing road not within the disturbed area for which construction was complete prior to August 1, 1995. As shown on Map 2.05.3(3)-8, the grade of the road does not exceed the requirements of 4.03.1(3). The road width varies (average width 30’) and is appropriate for the volume of traffic and weight and speed of vehicles used. Cut and slopes and embankment slopes along the road also do not exceed the requirements of 4.03.1(3).

Drainage

The Lincoln Street Haul Road will utilize existing ditches and culverts to provide adequate drainage. The water control system has been designed to safely pass peak runoff from a 10-year, 24-hour precipitation event. Refer to Attachment 2.05.3(3)-1 for culvert and ditch designs.

Surfacing

The Lincoln Street Haul Road is an existing road that is currently surfaced with sufficiently durable material (rock, gravel) for the volume of traffic and weight and speed of vehicles used. Acid- or toxic-forming substances will not be used for surfacing.

Maintenance

The Lincoln Street Haul Road will be maintained such that required standards are met throughout the life of the facility. Maintenance will include blading, replacement of surfacing material, brush removal, and watering for dust control. Other commercial products may be utilized for fugitive dust control and will be applied according to manufacturer recommendation.

Reclamation

Unless the Division approves retention of the Lincoln Street Haul Road as part of the postmining land use, the road will be reclaimed in accordance with 4.03.1(7) after it is no longer needed.

I. Access Roads

Under the definition of Access Road provided in Section 1.04 of the Rules, there are no access roads within the permit area.

J. Light-Use Roads

Under the definition of Light-Use Road provided in Section 1.04 of the Rules, there are no light-use roads within the permit area.

K. Support Facilities

Buildings

Map 2.05.3(3)-1 shows the locations of the existing buildings. Details of sizes and types of construction for all buildings are shown on Table 2.05.3(3)-4. See Attachment 2.05.3(3)-17 for landowner letters retaining buildings as permanent structures.

Table 2.05.3(3)-3 Building Inventory

Building Function	Building Construction	Building Foundation	Concrete Floor Thickness	Length (feet)	Width (feet)	Height (feet)	Post Mine Plans
Shop	Steel	Concrete	8-12 in.	77 ft.	52 ft.	40 ft.	Remain for farm support
Washbay	Open	Concrete	8-12 in.	31 ft.	52 ft.	N/A	Remain for farm support
Shop addition	Steel	Concrete	8-12 in.	37 ft.	10 ft.	12 ft.	Remain for farm support
Foreman's Office	Trailer	N/A	N/A	37 ft.	10 ft.	12 ft.	Storage or tow away
Mine Office	Trailer	N/A	N/A	39 ft.	25 ft.	12 ft.	Will revert to residence
Engineer's Office	Residential	Concrete	N/A	82 ft.	35 ft.	12 ft.	Will revert to residence
Change Room	Trailer	N/A	N/A	60 ft.	14 ft.	12 ft.	Remain for farm support
Training Building	Cinder Block	Concrete	4-6 in.	32 ft.	21ft.	12 ft.	Remain for farm support
Warehouse (Open)	Cinder Block	Concrete	4-6 in.	90 ft.	24 ft.	12 ft.	Remain for farm support
Warehouse (Enclosed)	Cinder Block	Concrete	4-6 in.	47 ft.	32 ft.	12 ft.	Remain for farm support
Engineer's Garage	Wood Frame	Concrete	4-6 in.	24 ft.	22 ft.	8 ft.	Will support residence
Container A	Steel	N/A	N/A	40 ft.	8 ft.	8 ft.	Storage or tow away
Container B	Steel	N/A	N/A	40 ft.	8 ft.	8 ft.	Storage or tow away
Container C	Steel	N/A	N/A	20 ft.	8 ft.	8 ft.	Storage or tow away
Container D	Steel	N/A	N/A	20 ft.	8 ft.	8 ft.	Storage or tow away
Cargo Trailer	Steel	N/A	N/A	40 ft.	8 ft.	8 ft.	Storage or tow away

Waste Water

Sewage from the existing buildings will be disposed of through an existing sanitary sewer lines discharging into a sewer main on Lincoln Street which is owned by the Nucla Sanitary District. Waste water from the equipment wash will be run through a sediment trap and an oil water separator and discharged to Pond 018 via a natural drainage.

Domestic Water

Potable water will be provided through a water line tied into the Town of Nucla water system.

Solid Wastes

Solid waste will be picked up by the local waste disposal contractor for disposal in the Montrose County Landfill. The land fill is privately owned and operates under the regulations mandated by the State of Colorado and Montrose County. Solid wastes not suitable for disposal at the landfill will be transported to and disposed of in suitable, licensed facilities under the applicable Federal and State regulations. When practicable, solid wastes will be separated for recycling.

Fuel Storage

One above ground fuel tank will be utilized. One tank of approximately 1,000 gallons capacity will be used for gasoline storage. The gasoline tank is located at the fuel and lubricant storage and dispensing facility proximal to the truck shop. The tank is enclosed by berms and has spill prevention and safety protection devices as mandated by the appropriate regulatory authorities. Spill prevention and containment measures will be implemented under the New Horizon Mine Spill Prevention Control and Counter-measure (SPCC) Plan.

Support Facilities and Utility Installations

All support facilities used in connection with the operation of the mine, including but not limited to, mine buildings, equipment storage facilities, sheds, shops and other buildings will be designed, constructed or reconstructed and located to minimize or control erosion and siltation, water pollution and damage to public or private property. Services which run through pass over, or under the permit area, consisting of power, sewage, water, telephone lines and wells will be protected against damage or relocated to prevent or minimize the disruption of service.

At various times, other support facilities such as power poles and irrigation pumps may be located on bond released areas to provide permanent support to landowners for postmining land use activities. These facilities are not associated with New Horizon's mining activities and should not be required to be permitted or bonded in accordance with Rule 3.02.1(2). *Irrigation System*

An irrigation pump station has been established along the north permit boundary to furnish additional water to the irrigation system, see Map 2.05.3(3)-1 for location. This irrigation system will enhance the revegetation on the irrigated pastureland portion of the final reclamation. All information on topsoil and overburden stockpiles is given in Section 2.05.4.

Relocation of the CCC West Lateral Ditch

An agreement between the Colorado Cooperative Company (CCC) and New Horizon was reached to install a primary 26" HDPE pipeline and a secondary 12" HDPE pipeline to temporary divert and distribute approximate 38cfs of water to the lawful water share owners while mining through the original West Lateral Ditch located within the permit boundary. After the land was reclaimed, the same pipelines were reinstalled into the approximate original right of way of the original open ditch. Gate valves and mechanical flow meters were installed at agreed upon locations along the pipeline so each land owner could meter their shares of water out of one or the other or both of the two main pipelines. It was decided and agreed upon that a big benefit of keeping the pipelines as a permanent structure across the final graded reclamation was that leakage of water from an open ditch through disturbed ground would be eliminated, plus it would give the downstream water users some pressure to better irrigate their land with.

A 12" HDPE pipeline, with three takeouts, will be installed along BB Road west of 2700 Road to provide irrigation water for the Morgan and ERMR properties on that side of the mine. The location of the pipeline structure on Map 2.05.4-5 is the permanent location. The design details and historical information regarding the ditch relocation can be seen below.

Pond Construction

Pond 013 was designed and constructed as a largely subgrade impoundment with a low (approximately 5 feet high) embankment along the northwestern end across a natural swale. The details can be observed on Map 2.05.3(3)-32. The primary, or "service" spillway consists of an 24-inch perforated riser connecting to an 24-inch CMP under the above described low embankment. The overflow lip is at elevation 5555.0. There is a pair of 6-inch diameter valves in the riser with invert at elevation 5552.0, which sets the maximum normal pool at this level. The pond is normally operated as a "pass through" design with both valves left in the open condition. In addition, there are three parallel 18-inch diameter 20-foot long horizontal corrugated metal pipes with upstream invert elevation 5557.0 which serve as an emergency spillway system.

Pond 013 embankment compaction results and safety calculations are also presented in Appendix 1 and 2 of this attachment.

Inflow Calculation Results

The results of the runoff calculations and synthesized constant inflow are presented in the attached SEDCAD model outputs. The system was modeled using SEDCAD for its response to a 10 year, 24 hour storm of 2.0 inches for the sediment control analysis, and the 25 year, 24 hour storm of 2.4 inches for the spillway evaluation. In both cases, a constant base case inflow of 1,000 gpm was also included. For continuity, the results of these models are presented below along with the discussion of the physical dimensions and properties of the pond.

The volume of the pond was inputted into the SEDCAD model, along with its spillway details. The model watersheds were inputted as a series of sub-watersheds, each with its own acreage, its own flow response parameters (slope, distance, time of concentration), and the specific runoff Curve Numbers from Table 2.05.3(3)-1. The 10 year, 24 hour storm was then applied to the composite watershed, and routed down to the sediment pond. SEDCAD allows the user to override the customary starting pool that is set by the lowest drain hole. In the case of the 10 year storm, where the starting pool is normally set by the twin 6-inch valves with invert at elevation 5552.0, the starting pool at the start of the design storm needs to be 1.43 feet higher, or elevation 5553.43 to account for the 1,000 gpm flowing through the two orifices at the start of the storm. It can be observed in the SEDCAD outputs that the storm and fixed inflow generate runoff of 6.12 ac ft of inflow and that the pool rises to 5554.32 feet during the routing of this event. The SEDCAD results show the pond has a trap efficiency of 65.7%, and it releases water with a 24-hour weighted settleable solids concentration of 0.14 ml/l, well below the 0.50 ml/l standard.

The 25 year, 24 hour storm has also been modeled as the spillway design event. For this analysis, it has been conservatively assumed that the twin 6-inch orifice holes are closed, and normal starting pool is the principal spillway elevation of 5555.0. This must be raised 0.23 feet to account for the 1,000 gpm over the riser lip. The starting pool for the 25 year spillway design storm was thus set to elevation 5555.23. The runoff combined with the constant inflow produce a total runoff volume of 9.14 ac-ft. In the attached SEDCAD printout for that storm it can be observed that the pool only rises to elevation. 5556.36, or 1.36 feet above the riser pipe overflow. As such, the routed 25 year storm does not raise the pool high enough to engage the three horizontal CMPs at El 5557.0, which are the emergency spillway.

SEDCAD model allows for an estimate of the annual sediment collected in the pond. The methodology is described on page 64 of the SEDCAD User's Manual, and requires an Annual R factor (rainfall-erosivity factor). The value of R at 27 can be interpolated from Figure 5.3 presented in Barfield, Warner and Haan (1981). In addition the total tonnage of sediment from the modeled storm, in this case 10 year, 24 hour storm, is required. This is obtained from the SEDCAD output by subtracting from tons flowing into the pond (63.7 tons) the sediment tonnage into the null below the pond (21.2 tons).

The net 42.5 tons from a single 10 year, 24 hour storm is converted to annual tons via the method described in the SEDCAD User's Manual to 60.9 tons. This weight is then converted to volume, using a density of 78 lb/cu ft, to arrive at the projected annual volume collected in the pond of 0.036 ac-ft. According to the stage-storage curve, there are 2.40 ac ft of available storage between the pond floor (elevation 5549) and the invert of the twin 6-inch valves on the riser. Thus, over a period of 10 years approximately 0.36 ac-ft of sediment would be accumulated in the pond bottom with the watershed in its current revegetated condition. This is small enough to not significantly affect the trap efficiency of this pond.

The SEDCAD printout shows the 10 year, 24 hour storm flows in Ditch C9 to be 4.65 cfs in the 10 year storm, and flowing at a velocity of 1.4 fps, well below the allowable velocity of 7 fps for the grass lined channels at these conditions.

Following establishment of the postmining topography to final grade, an inlet ditch into the pond will be excavated as shown on Map 2.05.3(3)-32. Details of this inlet channel, along with dimensions and erosion protection details and other information is also provided for this feature.

REFERENCES

Barfield, Warner, & Haan (1981). "*Applied Hydrology and Sedimentology for Disturbed Areas*". Oklahoma Technical Press, Stillwater, OK.

Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder (1996). "Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation (RUSLE)". *Agricultural Handbook No. 703*. U.S. Department of Agriculture. Washington, DC.

Schwab and Warner (1998). "*SEDCAD4 Users Manual*". Civil Software Design. Lexington, KY.

Soil Conservation Service (1986). "*Urban Hydrology for Small Watersheds (TR-55)*". Soil Conservation Service. Washington, DC.

Striffler and Rhodes (1981). "Hydrologic and Erosional Characteristics of Regraded Surface Coal Mined Lands in Colorado", Dept. of Earth Resources, Colorado State University, Ft. Collins, CO.

USDA (January 2009), National Resources Conservation Service, National Engineering

Handbook (NEH), Chapter 7, “Hydrologic Soil Groups”

Appendix 1

Pond 013 Embankment Compaction Results

RELATIVE COMPACTION TEST RESULTS

PROJECT: Western Fuels' Ponds | **PROJECT NO:** M07117MT | **DATE:** Wednesday, Oct/17/07

Page 1 of 2

SITE LOCATION: Nucla | **ENGINEERING TECHNICIAN:** Sanborn

CLIENT: Williams Construction | **NUCLEAR GAUGE USED:** 16

TEST NO	TEST LOCATION	DEPTH OR ELEVATION	PROBE DEPTH (IN)	LABORATORY PROCTOR DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	RELATIVE COMPACTION (%)	SOIL TYPE
1	150 ft. from east end, embankment keyway	Bottom	8	117.5	13.0	106.1	20.3	90	Sandy Clay, Brown
2	250 ft. from east end, embankment keyway	"	8	117.5	13.0	105.4	18.3	90	" "
3	150 ft. from east end, embankment keyway	Top of 12 in. Plus Lift	6	117.5	13.0	104.7	10.1	89	" "
4	250 ft. from east end, embankment keyway	18 in. Above Bottom	6	117.5	13.0	102.7	10.0	87	" "
5	100 ft. from east end, embankment keyway	Top of New 18 in. Plus Lift	6	117.5	13.0	105.7	9.7	90	" "
6	200 ft. from east end, embankment keyway	36 in. Above Bottom	6	117.5	13.0	102.8	10.4	87	" "
7	Center, primary spillway	"	8	117.5	13.0	103.1	21.3	88	" "
8	Key at 12 ft. south of pipe	Ground	8	117.5	13.0	103.8	16.4	88	" "
9	15 ft. west of primary spill north of pipe	Top Primary Barrel	8	117.5	13.0	107.3	16.0	91	" "
10	15 ft. west of primary south of pipe	"	8	117.5	13.0	106.5	19.0	91	" "

REMARKS: The test results indicate only the density and moisture content for the location and elevation tested only.

Lambert and Associates — PROJECT NUMBER: M07117MT

RELATIVE COMPACTION TEST RESULTS

PROJECT: Western Fuels' Ponds | **PROJECT NO:** M07117MT | **DATE:** Wednesday, Oct/17/07
Page 2 of 2

SITE LOCATION: Nucla | **ENGINEERING TECHNICIAN:** Sanborn

CLIENT: Williams Construction | **NUCLEAR GAUGE USED:** 16

TEST NO	TEST LOCATION	DEPTH OR ELEVATION	PROBE DEPTH (IN)	LABORATORY PROCTOR DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	RELATIVE COMPACTION (%)	SOIL TYPE
11	Key at 24 ft. south of pipe	Ground	8	117.5	13.0	103.0	12.3	88	Sandy Clay, Brown
12	15 ft. west primary spill, south of pipe	#10 plus 1 ft.	4	117.5	13.0	103.6	13.3	88	" "
13	15 ft. west primary spill, north of pipe	#9 plus 1 ft.	6	117.5	13.0	102.3	14.2	87	" "
14	East end embankment plus 20 ft.	Ground	8	117.5	13.0	104.8	13.4	89	" "
15	East end embankment plus 100 ft.	"	8	117.5	13.0	107.5	14.2	91	" "
16	East end embankment plus 200 ft.	"	8	117.5	13.0	111.6	14.9	95	" "

REMARKS: The test results indicate only the density and moisture content for the location and elevation tested only.

Lambert and Associates — PROJECT NUMBER: M07117MT

RELATIVE COMPACTION TEST RESULTS

PROJECT: Western Fuels' Ponds **PROJECT NO: M07117MT** **DATE: Thursday, Oct/18/07**

SITE LOCATION: Nucla **ENGINEERING TECHNICIAN: Sanborn**

CLIENT: Williams Construction **NUCLEAR GAUGE USED: 16**

TEST NO	TEST LOCATION	DEPTH OR ELEVATION	PROBE DEPTH (IN)	LABORATORY PROCTOR DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	RELATIVE COMPACTION (%)	SOIL TYPE
17	North side pipe 50 ft. west spillway	Grade	8	117.5	13.0	112.5	15.5	96	Sandy Clay, Brown
18	Center of pipe grade 10 ft. west spillway	Below Pipe	8	117.5	13.0	90.8	34.7	77	" "
19	South side pipe 10 ft. from inlet	Lift 10 ft. Above	8	117.5	13.0	99.1	13.0	84	" "
20	North side pipe 10 ft. from inlet	Above 20 in. Lift	8	117.5	13.0	103.4	12.0	88	" "
21	South side pipe 15 ft. from inlet	"	8	117.5	13.0	104.9	12.2	89	" "
22	North side pipe 15 ft. from inlet	Above Top Pipe	8	117.5	13.0	104.5	12.2	89	" "
23	South side pipe 18 ft. from inlet	"	8	117.5	13.0	101.2	11.8	86	" "
24	North side pipe 15 ft. from inlet	10 in. Above Pipe	8	117.5	13.0	105.1	13.7	89	" "
25	South side pipe 15 ft. from inlet	"	8	117.5	13.0	103.2	11.0	88	" "
26	North side pipe 15 ft. from outlet	Mid Level Pipe	8	117.5	13.0	106.6	10.8	91	" "

REMARKS: The test results indicate only the density and moisture content for the location and elevation tested only.

Lambert and Associates **PROJECT NUMBER: M07117MT**

RELATIVE COMPACTION TEST RESULTS

PROJECT: Western Fuels' Ponds **PROJECT NO: M07117MT** **DATE: Thursday, Oct/18/07**

SITE LOCATION: Nucla **ENGINEERING TECHNICIAN: Sanborn**

CLIENT: Williams Construction **NUCLEAR GAUGE USED: 16**

TEST NO	TEST LOCATION	DEPTH OR ELEVATION	PROBE DEPTH (IN)	LABORATORY PROCTOR DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	RELATIVE COMPACTION (%)	SOIL TYPE
27	North side pipe 10 ft. from outlet	10 in. Above Pipe	8	117.5	13.0	98.9	12.3	84	Sandy Clay, Brown
28	South side pipe 15 ft. from outlet	Top Pipe	8	117.5	13.0	100.5	13.5	86	" "
29	North side pipe 20 ft. from outlet	"	8	117.5	13.0	102.5	11.9	87	" "
30	South side pipe 20 ft. from outlet	10 in. Above Pipe	8	117.5	13.0	103.2	12.2	88	" "
31	North side pipe 10 ft. from outlet	"	8	117.5	13.0	98.9	12.9	84	" "
32	Center pipe 25 ft. from outlet	Bottom Embankment Level	8	117.5	13.0	106.5	11.8	91	" "
33	Center pipe 20 ft. from inlet	"	8	117.5	13.0	108.7	12.3	93	" "
34	30 ft. from northwest end embankment	Top 12 in. 1st Lift Embankment	8	117.5	13.0	108.4	17.9	92	" "
35	120 ft. from northwest end embankment	"	8	117.5	13.0	105.8	18.1	90	" "
36	Outside edge, center outlet pipe embankment	Top 2nd 12 in. Lift	8	117.5	13.0	108.2	18.0	92	" "
37	#20 plus 100 ft. inside edge embankment	Top 2nd 12 in. Lift	8	117.5	13.0	102.8	19.5	87	" "

REMARKS: The test results indicate only the density and moisture content for the location and elevation tested only.

Lambert and Associates **PROJECT NUMBER: M07117MT**

RELATIVE COMPACTION TEST RESULTS

PROJECT: Western Fuels' Ponds **PROJECT NO:** M07117MT **DATE:** Friday, Oct/19/07

SITE LOCATION: Nucla **ENGINEERING TECHNICIAN:** Sanborn

CLIENT: Williams Construction **NUCLEAR GAUGE USED:** 16

TEST NO	TEST LOCATION	DEPTH OR ELEVATION	PROBE DEPTH (IN)	LABORATORY PROCTOR DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	RELATIVE COMPACTION (%)	SOIL TYPE
38	Southwest end embankment plus 10 ft. middle	4 ft. Above Top Outlet	8	117.5	13.0	105.8	21.1	90	Clay, Brown
39	#2 plus 100 ft. outside edge top	"	8	117.5	13.0	107.5	20.2	91	" "
40	#3 plus 100 ft. inside edge	"	8	117.5	13.0	111.9	16.6	95	" "
41	Southwest end, tope of pipe, inside edge	Final Grade	8	117.5	13.0	102.2	22.0	87	" "
42	Southwest end embankment, outside edge	"	8	117.5	13.0	107.3	19.2	91	" "

REMARKS: The test results indicate only the density and moisture content for the location and elevation tested only.

Lambert and Associates PROJECT NUMBER: M07117MT

RELATIVE COMPACTION TEST RESULTS

PROJECT: Western Fuels' Ponds | **PROJECT NO:** M07117MT | **DATE:** Thursday, Nov/1/07 Page 2 of 2

SITE LOCATION: Nucla | **ENGINEERING TECHNICIAN:** Sanborn

CLIENT: Williams Construction | **NUCLEAR GAUGE USED:** 16

	TEST NO	TEST LOCATION	DEPTH OR ELEVATION	PROBE DEPTH (IN)	LABORATORY PROCTOR DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	RELATIVE COMPACTION (%)	SOIL TYPE
Pond 11	52	175 ft. west of centerline	48 in. Above Native Soil	8	127.0	10.5	115.8	12.1	91	Clay, Sand, Gravelly with Sandstone
		#13								
Pond 213	53	Southwest end of dam, outside edge, at tie in to hill	Top of Dam	8	117.5	13.0	118.9	11.2	100	Sandy Clay, Brown
	54	100 ft. northeast along dam, outside edge, from test #53	"	8	117.5	13.0	122.7	10.6	100	" "
	55	200 ft. northeast along dam, middle, from test #53	"	8	117.5	13.0	114.3	9.9	97	" "
	56	300 ft. northeast along dam, outside edge, from test #53	"	8	117.5	13.0	118.1	10.8	100	" "
?	57	410 ft. northeast along dam, from test #53, centerline overflow pipe, inside edge	"	8	117.5	13.0	109.8	9.0	93	" "

REMARKS: The test results indicate only the density and moisture content for the location and elevation tested only.

Lambert and Associates | PROJECT NUMBER: M07117MT

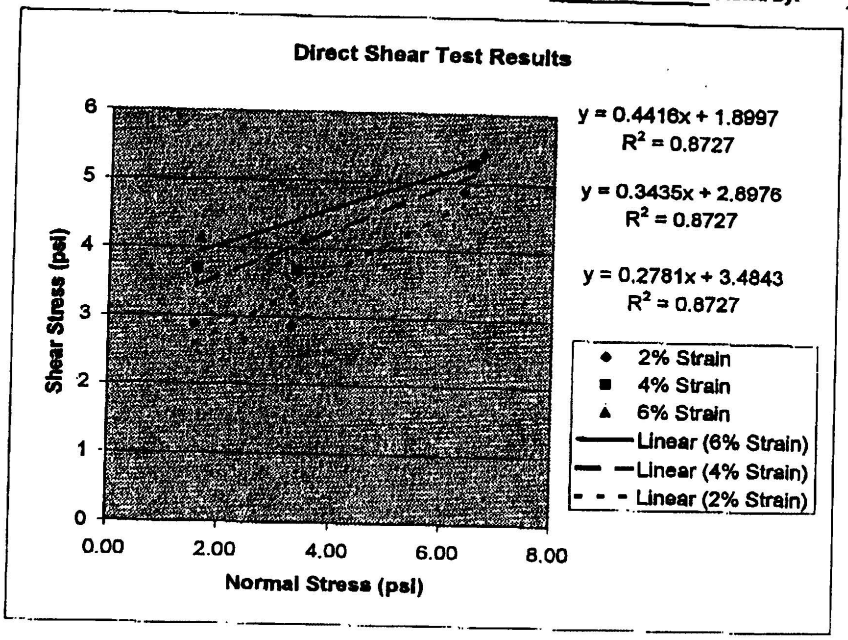
Appendix 2

Pond 013 Embankment Safety Calculations

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

Project: Western Fuels Miscellaneous Testing **Project Number:** M07057MT **Date Sampled:** 5/7/2007
Location: **Sample Source:** TP 2 @ 0-5.5 ft **Lab Sample #:** 0770
Sample Description: Clay, Sandy, Brown **Date Tested:** 6/21/2007 **Tested By:** AC



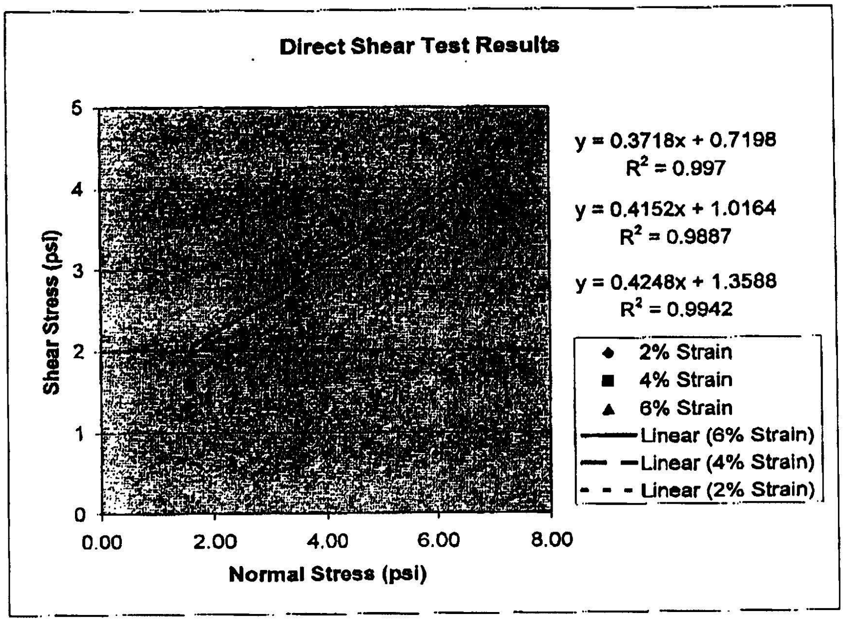
Soil remolded to approximately 100% ASTM D698 Maximum Dry Density
Remolded Dry Density = 114.5 pcf Moisture Content = 12.4%

% Strain	Cohesion (psf)	Friction Angle (deg)
2	274	24
4	417	19
6	502	16

Lambert and Associates

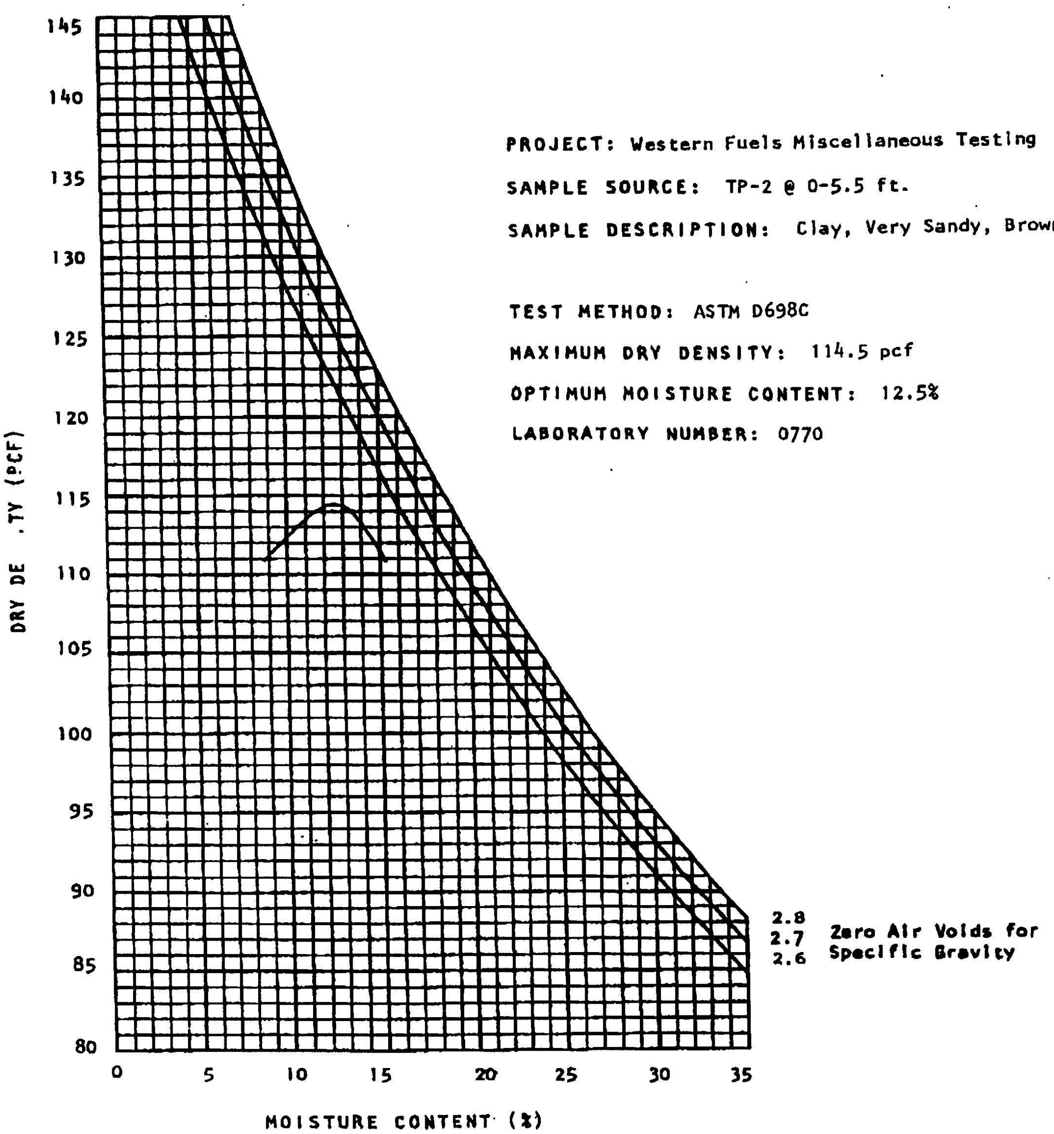
CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

Project:	Western Fuels Miscellaneous Testing	**Project Number:**	M07057MT	**Date Sampled:**	
Location:		**Sample Source:**	TP 2 @ 0-5.5 ft	**Lab Sample #:**	0770
Sample Description:	Clay, Sandy, Brown	**Date Tested:**	6/4/2007	**Tested By:**	AC



Soil remolded to approximately 85% ASTM D698 Maximum Dry Density
Remolded Dry Density = 97 pcf Moisture Content = 9.7%

% Strain	Cohesion (psf)	Friction Angle (deg)
2	104	20
4	146	23
6	196	23



PROJECT: Western Fuels Miscellaneous Testing

SAMPLE SOURCE: TP-2 @ 0-5.5 ft.

SAMPLE DESCRIPTION: Clay, Very Sandy, Brown

TEST METHOD: ASTM D698C

MAXIMUM DRY DENSITY: 114.5 pcf

OPTIMUM MOISTURE CONTENT: 12.5%

LABORATORY NUMBER: 0770

Lambert and Associates M07057MT May/7/07

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

Client: Western Fuels

Date Sampled: May/7/07

Project: Miscellaneous Testing

Date Tested: May/07

Project Number: M07057MT

Sample Number: 0770

Location:

Sample Source: TP-1 @ 0-6.5 ft.
Pond 013

Sample Description: Sand, Very Clayey, Brown

SIEVE ANALYSIS TEST RESULTS

U.S. STD SIEVE SIZE	CUMULATIVE PERCENT PASSING
3/8"	100
No. 4	99
No. 8	99
No. 10	99
No. 16	99
No. 30	98
No. 40	97
No. 50	92
No. 100	65
No. 200	45
Moisture Content	4.99%

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

Client: Western Fuels

Project: Miscellaneous Testing

Project Number: M07057MT

Location:

Sample Description: Clay, Very Sandy, Brown

Date Sampled: May/7/07

Date Tested: May/23/07

Sample Number: 0770

Sample Source: TP-2 @ 0-5.5 ft.
Pond 013

SIEVE ANALYSIS TEST RESULTS

U.S. STD SIEVE SIZE	CUMULATIVE PERCENT PASSING
No. 16	100
No. 30	99
No. 40	99
No. 50	95
No. 100	78
No. 200	58
Moisture Content	6.05%

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

Client: Western Fuels

Date Sampled: May/7/07

Project: Miscellaneous Testing

Date Tested: May/24/07

Project Number: M07057MT

Sample Number: 0770

Location:

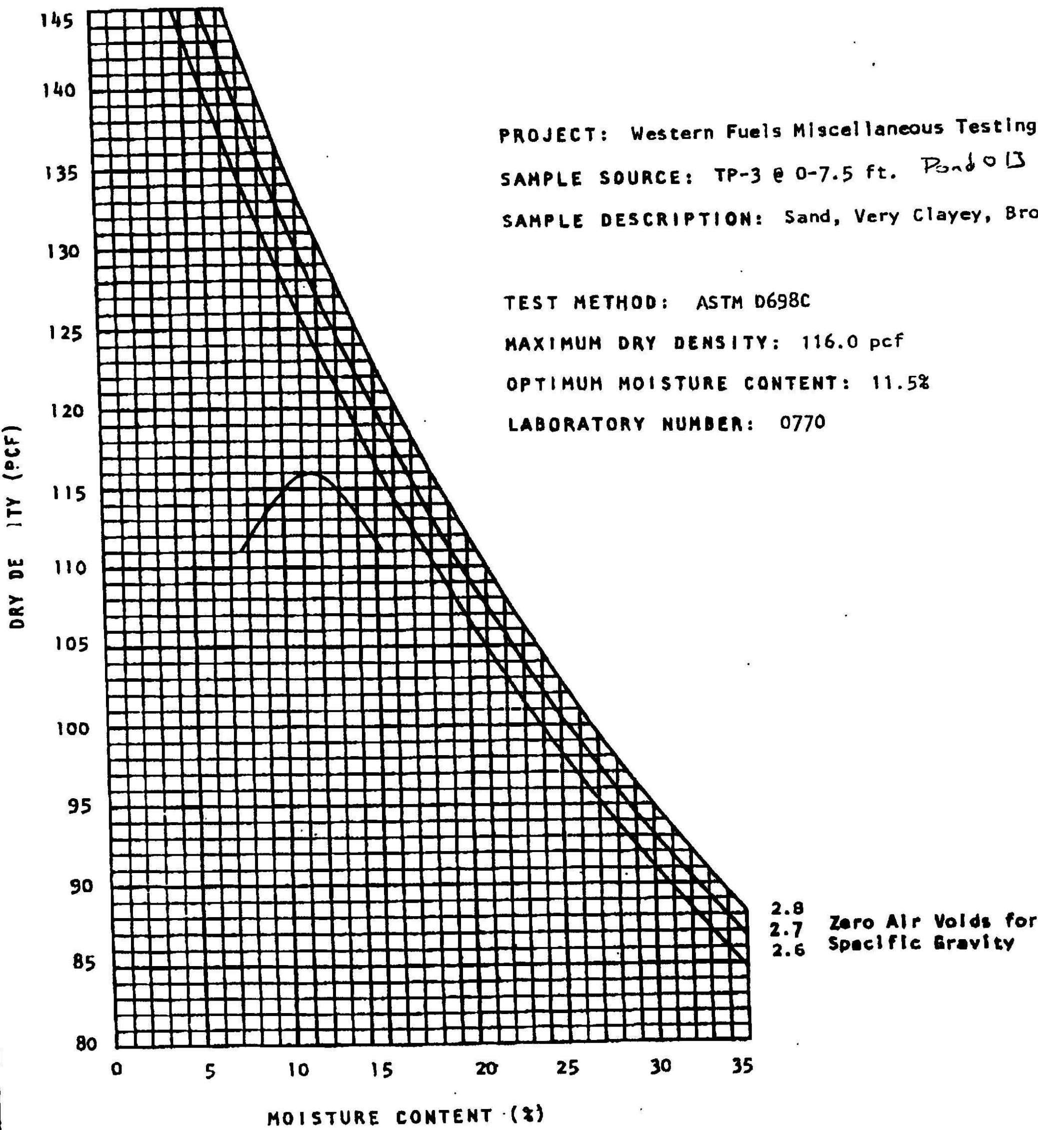
Sample Source: TP-3 @ 0-7.5 ft.

Pond 013

Sample Description: Sand, Very Clayey, Brown

SIEVE ANALYSIS TEST RESULTS

U.S. STD SIEVE SIZE	CUMULATIVE PERCENT PASSING
1/2"	100
3/8"	99
No. 4	99
No. 8	99
No. 10	99
No. 16	98
No. 30	97
No. 40	95
No. 50	91
No. 100	67
No. 200	50
Moisture Content	6.7%



PROJECT: Western Fuels Miscellaneous Testing

SAMPLE SOURCE: TP-3 @ 0-7.5 ft. Pond 013

SAMPLE DESCRIPTION: Sand, Very Clayey, Brown

TEST METHOD: ASTM D698C

MAXIMUM DRY DENSITY: 116.0 pcf

OPTIMUM MOISTURE CONTENT: 11.5%

LABORATORY NUMBER: 0770

Lambert and Associates

M07057MT

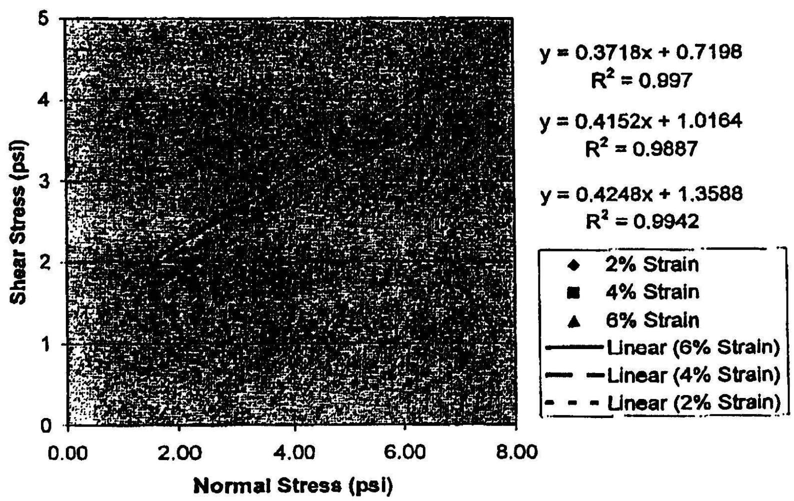
May/7/07

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

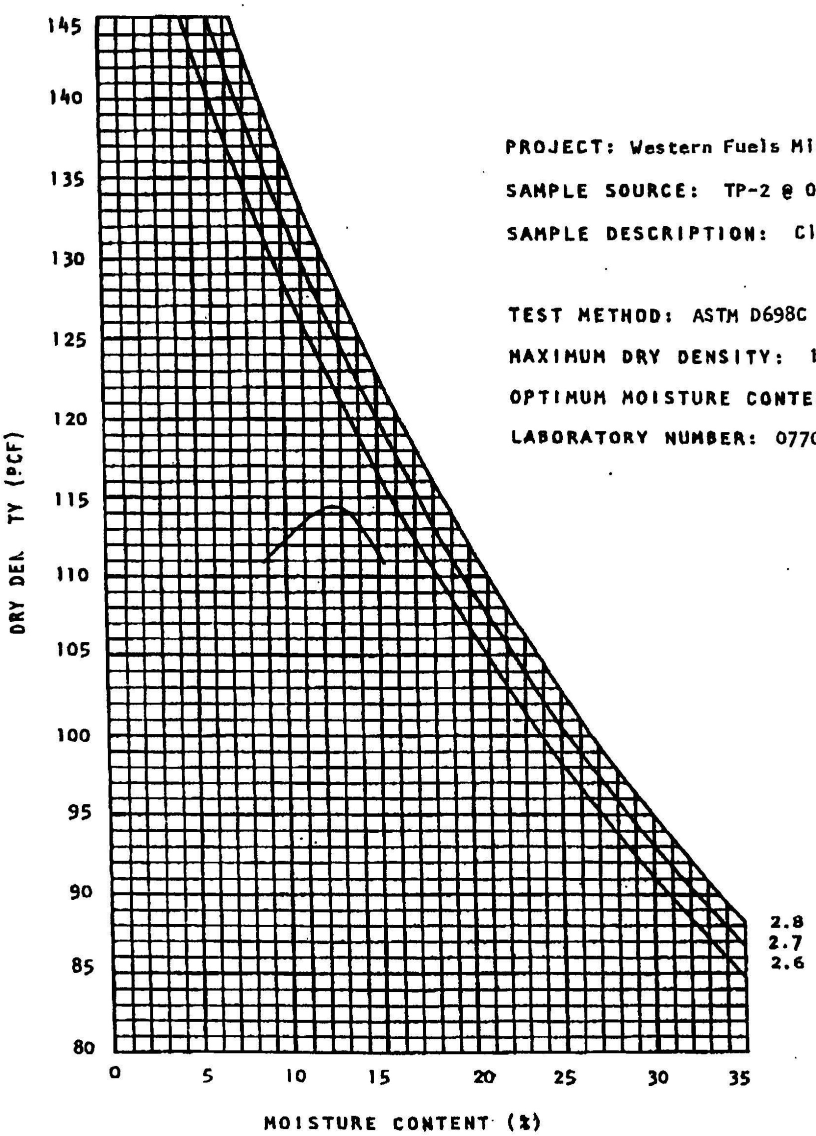
Project:	Western Fuels Miscellaneous Testing	**Project Number:**	M07057MT	**Date Sampled:**	
Location:		**Sample Source:**	TP 2 @ 0-5.5 ft	**Lab Sample #:**	0770
Sample Description:	Clay, Sandy, Brown	**Date Tested:**	6/4/2007	**Tested By:**	AC

Direct Shear Test Results



Soil remolded to approximately 85% ASTM D698 Maximum Dry Density
Remolded Dry Density = 97 pcf Moisture Content = 9.7%

% Strain	Cohesion (psf)	Friction Angle (deg)
2	104	20
4	146	23
6	196	23



PROJECT: Western Fuels Miscellaneous Testing

SAMPLE SOURCE: TP-2 @ 0-5.5 ft.

SAMPLE DESCRIPTION: Clay, Very Sandy, Brown

TEST METHOD: ASTM D698C

MAXIMUM DRY DENSITY: 114.5 pcf

OPTIMUM MOISTURE CONTENT: 12.5%

LABORATORY NUMBER: 0770

Lambert and Associates

M07057MT

May/7/07

PROJECT: Western Fuels Miscellaneous Testing

SAMPLE SOURCE: TP-1 @ 0-6.5 ft.

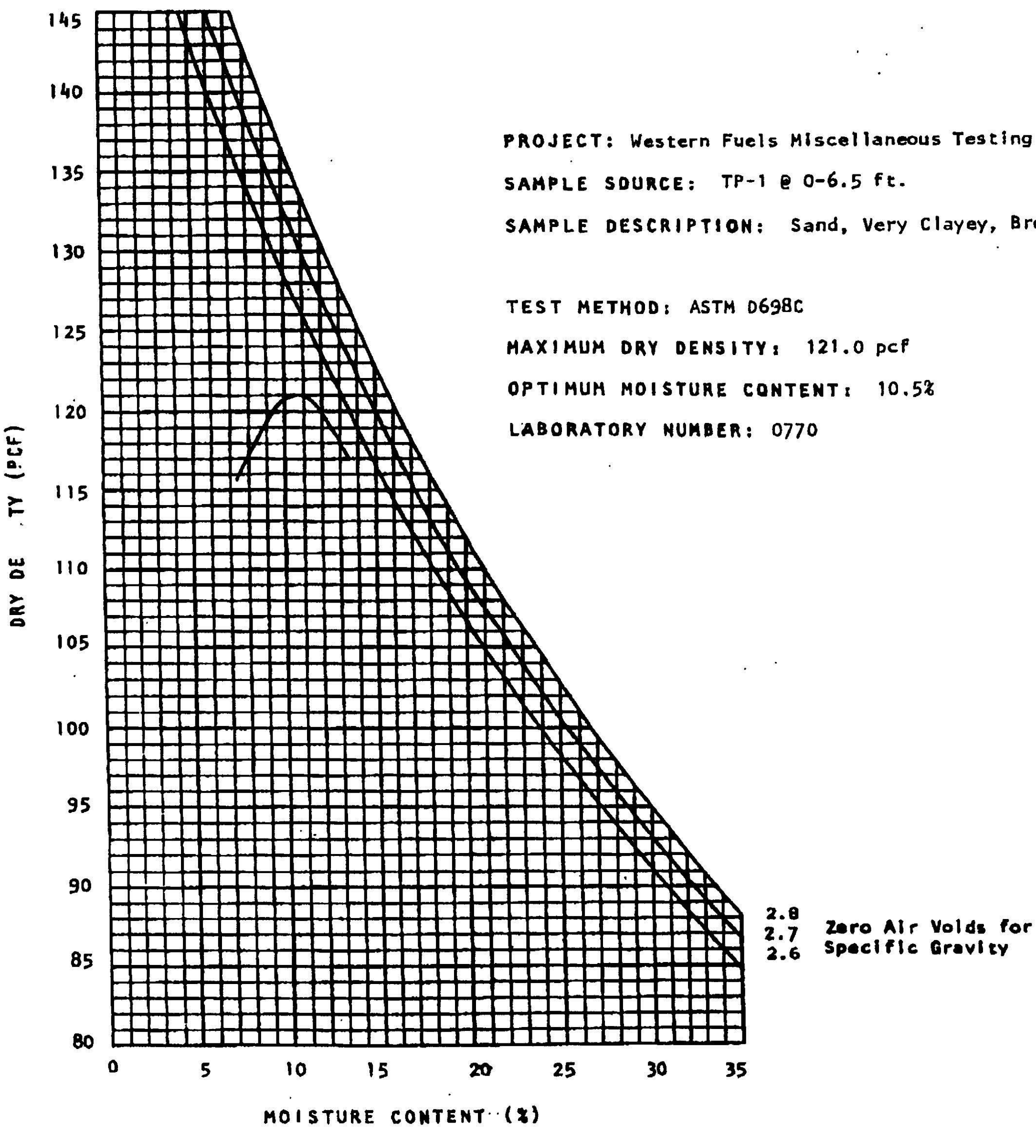
SAMPLE DESCRIPTION: Sand, Very Clayey, Brown

TEST METHOD: ASTM D698C

MAXIMUM DRY DENSITY: 121.0 pcf

OPTIMUM MOISTURE CONTENT: 10.5%

LABORATORY NUMBER: 0770



Lambert and Associates

M07057MT

May/7/07

Pond 013
10-Yr 24-Hour Effluent Demonstration

Flow Through Design Both 6" Valves Open and Constant 1000 gpm Flow

Tony Tennyson

Tri-State Generation & Transmission Assoc., Inc.
1100 West 116th Avenue
Westminster, CO 80234

Phone: (970) 824-1232
Email: ttennyson@tristategt.org

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	New Horizon 2
4.0000	100.000%
2.0000	100.000%
1.0000	80.000%
0.1000	65.000%
0.0500	55.000%
0.0020	25.000%
0.0001	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Null Below Pond 013
Pond	#2	==>	#1	0.000	0.000	Pond 013
Channel	#3	==>	#5	0.000	0.000	Ditch C-9
Pond	#4	==>	#2	0.000	0.000	Continous flow 1000 gpm
Culvert	#5	==>	#2	0.000	0.000	Culvert C177 at Sta 0+25 in C-9 Ditch

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#3		6.710	6.710	4.65	0.34	17.9	74,702	35.18	17.66
#5		0.000	6.710	4.65	0.34	17.9	74,702	35.18	17.66
#4	In	100.000	100.000	40.62	2.91	0.1	47	0.02	0.01
	Out			2.23	2.91	0.0	16	0.00	0.00
#2	In	60.250	166.960	34.18	6.12	63.7	29,122	12.12	3.16
	Out			2.89	8.18	21.9	4,036	0.21	0.14
#1		0.000	166.960	2.89	8.18	21.9	4,035	0.21	0.14

Particle Size Distribution(s) at Each Structure

Structure #3 (Ditch C-9):

Size (mm)	In/Out
4.0000	100.000%
2.0000	100.000%
1.0000	80.000%
0.1000	65.000%
0.0500	55.000%
0.0020	25.000%
0.0001	0.000%

Structure #5 (Culvert C177 at Sta 0+25 in C-9 Ditch):

Size (mm)	In/Out
4.0000	100.000%
2.0000	100.000%
1.0000	80.000%
0.1000	65.000%
0.0500	55.000%
0.0020	25.000%
0.0001	0.000%

Structure #4 (Continous flow 1000 gpm):

Size (mm)	In	Out
4.0000	100.000%	100.000%
2.0000	100.000%	100.000%
1.0000	80.000%	100.000%
0.1000	65.000%	100.000%
0.0500	55.000%	100.000%
0.0020	25.000%	80.301%
0.0001	0.000%	0.000%

Structure #2 (Pond 013):

Size (mm)	In	Out
4.0000	100.000%	100.000%
2.0000	100.000%	100.000%
1.0000	89.540%	100.000%
0.1000	76.212%	100.000%
0.0500	64.493%	100.000%
0.0020	29.328%	85.369%
0.0001	0.000%	0.000%

Structure #1:

Size (mm)	In/Out
4.0000	100.000%
2.0000	100.000%
1.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	85.369%
0.0001	0.000%

Structure Detail:

Structure #3 (Vegetated Channel)

Ditch C-9

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.00	2.0:1	2.0:1	3.2	D, B	0.30			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	4.65 cfs		4.65 cfs	
Depth:	0.50 ft	0.80 ft	0.93 ft	1.23 ft
Top Width:	5.00 ft	6.20 ft	6.71 ft	7.91 ft
Velocity:	2.32 fps		1.03 fps	
X-Section Area:	2.00 sq ft		4.51 sq ft	
Hydraulic Radius:	0.383 ft		0.630 ft	
Froude Number:	0.65		0.22	
Roughness Coefficient:	0.0605		0.1896	

Structure #5 (Culvert)

Culvert C177 at Sta 0+25 in C-9 Ditch

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
20.00	2.50	0.0140	1.50	1.00	0.90

Culvert Results:

Design Discharge = 4.65 cfs

Minimum pipe diameter: 1 - 15 inch pipe(s) required

Structure #4 (Pond)

Continous flow 1000 gpm

Pond Inputs:

Initial Pool Elev:	90.01 ft
Initial Pool:	0.00 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	0.00 %

**No sediment capacity defined*

Pond Results:

Peak Elevation:	95.21 ft
H'graph Detention Time:	4.69 hrs
Pond Model:	CSTRS
Dewater Time:	0.04 days
Trap Efficiency:	68.87 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		Top of Sed. Storage
90.01	0.051	0.001	0.000		
90.50	0.077	0.032	2.228		
91.00	0.110	0.078	2.228		
91.50	0.147	0.142	2.228		
92.00	0.190	0.226	2.228		
92.50	0.224	0.330	2.228		
93.00	0.260	0.450	2.228		
93.50	0.303	0.591	2.228		
94.00	0.350	0.754	2.228		
94.50	0.394	0.940	2.228		
95.00	0.440	1.148	2.228		
95.21	0.461	1.243	2.228		
95.21	0.461	1.245	2.228	1.05	Peak Stage
95.50	0.489	1.381	2.228		
96.00	0.540	1.638	2.228		
96.50	0.594	1.921	2.228		
97.00	0.650	2.232	2.228		
97.50	0.704	2.571	2.228		
98.00	0.760	2.937	2.228		
98.50	0.819	3.331	2.228		
99.00	0.880	3.756	2.228		
99.50	0.949	4.213	2.228		
100.00	1.020	4.705	2.228		
100.50	1.127	5.242	2.228		

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
101.00	1.240	5.833	2.228	
101.50	1.319	6.473	2.228	
102.00	1.400	7.153	2.228	
102.50	1.498	7.877	2.228	
103.00	1.600	8.651	2.228	

Detailed Discharge Table

Elevation (ft)	User-input discharge (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
90.01	0.000	0.000
90.50	2.228	2.228
91.00	2.228	2.228
91.50	2.228	2.228
92.00	2.228	2.228
92.50	2.228	2.228
93.00	2.228	2.228
93.50	2.228	2.228
94.00	2.228	2.228
94.50	2.228	2.228
95.00	2.228	2.228
95.21	2.228	2.228
95.50	2.228	2.228
96.00	2.228	2.228
96.50	2.228	2.228
97.00	2.228	2.228
97.50	2.228	2.228
98.00	2.228	2.228
98.50	2.228	2.228
99.00	2.228	2.228
99.50	2.228	2.228
100.00	2.228	2.228
100.50	2.228	2.228
101.00	2.228	2.228
101.50	2.228	2.228
102.00	2.228	2.228
102.50	2.228	2.228
103.00	2.228	2.228

Structure #2 (Pond)

Pond 013

Pond Inputs:

Initial Pool Elev:	5,553.43 ft
Initial Pool:	3.72 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	20.00 %

**No sediment capacity defined*

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
24.00	5.50	24.00	100.00	3.40	0.0240	5,555.00	2

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
18.00	20.00	3.40	0.0240	5,557.00	0.90	0.00

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
18.00	20.00	3.40	0.0240	5,557.00	0.90	0.00

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
18.00	20.00	3.40	0.0240	5,557.00	0.90	0.00

Pond Results:

Peak Elevation:	5,554.34 ft
H'graph Detention Time:	6.38 hrs
Pond Model:	CSTRS
Dewater Time:	0.92 days
Trap Efficiency:	65.65 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,549.00	0.356	0.000	0.000		Top of Sed. Storage
5,549.50	0.440	0.199	0.000		
5,550.00	0.533	0.441	0.000		
5,550.50	0.658	0.739	0.000		
5,551.00	0.796	1.102	0.000		
5,551.50	0.944	1.536	0.000		
5,552.00	1.105	2.048	0.000		Low hole SPW #1
5,552.50	1.148	2.612	1.337	5.10*	
5,553.00	1.191	3.196	1.891	5.90	
5,553.43	1.228	3.717	2.261	3.00	
5,553.50	1.234	3.803	2.316	0.50	
5,554.00	1.276	4.430	2.674	3.05	
5,554.34	1.306	4.872	2.889	4.65	Peak Stage
5,554.50	1.319	5.079	2.990		
5,555.00	1.363	5.750	3.275		Spillway #1
5,555.50	1.410	6.443	6.886		
5,556.00	1.457	7.160	15.127		
5,556.50	1.499	7.899	18.526		
5,557.00	1.541	8.659	21.392		Spillway #2 Spillway #3 Spillway #4
5,557.50	1.584	9.440	27.251		
5,558.00	1.627	10.243	35.625		
5,558.50	1.670	11.067	45.621		
5,559.00	1.714	11.913	55.528		
5,559.50	1.759	12.781	63.505		
5,560.00	1.805	13.672	70.343		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Straight Pipe (cfs)	Straight Pipe (cfs)	Straight Pipe (cfs)	Combined Total Discharge (cfs)
5,549.00	0.000	0.000	0.000	0.000	0.000
5,549.50	0.000	0.000	0.000	0.000	0.000
5,550.00	0.000	0.000	0.000	0.000	0.000
5,550.50	0.000	0.000	0.000	0.000	0.000
5,551.00	0.000	0.000	0.000	0.000	0.000
5,551.50	0.000	0.000	0.000	0.000	0.000

Elevation (ft)	Perf. Riser (cfs)	Straight Pipe (cfs)	Straight Pipe (cfs)	Straight Pipe (cfs)	Combined Total Discharge (cfs)
5,552.00	6.00>0.000	0.000	0.000	0.000	0.000
5,552.50	1.337	0.000	0.000	0.000	1.337
5,553.00	1.891	0.000	0.000	0.000	1.891
5,553.43	2.261	0.000	0.000	0.000	2.261
5,553.50	2.316	0.000	0.000	0.000	2.316
5,554.00	2.674	0.000	0.000	0.000	2.674
5,554.50	2.990	0.000	0.000	0.000	2.990
5,555.00	3.275	0.000	0.000	0.000	3.275
5,555.50	6.886	0.000	0.000	0.000	6.886
5,556.00	15.127	0.000	0.000	0.000	15.127
5,556.50	18.526	0.000	0.000	0.000	18.526
5,557.00	21.392	0.000	0.000	0.000	21.392
5,557.50	23.917	(3)>1.111	(3)>1.111	(3)>1.111	27.251
5,558.00	26.200	(3)>3.142	(3)>3.142	(3)>3.142	35.625
5,558.50	28.299	(3)>5.774	(3)>5.774	(3)>5.774	45.621
5,559.00	30.253	(5)>8.425	(5)>8.425	(5)>8.425	55.528
5,559.50	32.089	(5)>10.472	(5)>10.472	(5)>10.472	63.505
5,560.00	33.824	(5)>12.173	(5)>12.173	(5)>12.173	70.343

Structure #1 (Null)

Null Below Pond 013

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	5.950	0.043	0.000	0.000	83.000	M	4.65	0.344
	2	0.760	0.000	0.000	0.000	57.000	M	0.00	0.000
	Σ	**6.710**						**4.65**	**0.344**
#5	**Σ**	**6.710**						**4.65**	**0.344**
#4	1	100.000	0.000	0.000	0.000	74.000	M	40.62	2.911
	Σ	**100.000**						**40.62**	**2.911**
#2	1	30.900	0.291	0.000	0.000	83.000	M	13.06	1.429
	2	7.110	0.118	0.000	0.000	83.000	M	5.56	0.411
	3	17.760	0.174	0.000	0.000	83.000	M	8.77	0.835
	4	3.340	0.031	0.000	0.000	83.000	M	2.61	0.193
	5	1.140	0.006	0.000	0.000	57.000	M	0.00	0.000
	Σ	**166.960**						**34.18**	**6.123**
#1	**Σ**	**166.960**						**2.89**	**8.179**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#3	1	0.300	200.00	8.80	0.8000	0.3800	1	17.9	74,702	35.18	17.66
	2	0.300	200.00	8.80	0.0700	0.3800	1	0.0	1	0.00	0.00
	Σ							**17.9**	**74,702**	**35.18**	**17.66**
#5	**Σ**							**17.9**	**74,702**	**35.18**	**17.66**
#4	1	0.300	200.00	0.10	0.0100	0.3800	1	0.1	47	0.02	0.01
	Σ							**0.1**	**47**	**0.02**	**0.01**
#2	1	0.300	200.00	2.30	0.8000	0.3800	1	17.6	17,015	5.80	3.08
	2	0.300	200.00	3.70	0.8000	0.3800	1	7.4	26,329	12.40	6.19
	3	0.300	200.00	2.90	0.8000	0.3800	1	12.8	21,603	8.17	4.22
	4	0.300	200.00	7.90	0.8000	0.3800	1	8.0	59,648	28.09	14.08
	5	0.300	108.00	32.30	0.8000	0.3800	1	0.0	1	0.00	0.00
	Σ							**63.7**	**29,122**	**12.12**	**3.16**
#1	**Σ**							**21.9**	**4,035**	**0.21**	**0.14**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	5. Nearly bare and untilled, and alluvial valley fans	2.32	37.00	1,594.82	1.520	0.291
#2	**1**	**Time of Concentration:**					**0.291**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	3.68	30.00	815.21	1.910	0.118
#2	**2**	**Time of Concentration:**					**0.118**
#2	3	5. Nearly bare and untilled, and alluvial valley fans	2.85	30.00	1,052.63	1.680	0.174
#2	**3**	**Time of Concentration:**					**0.174**
#2	4	5. Nearly bare and untilled, and alluvial valley fans	7.86	25.00	318.06	2.800	0.031
#2	**4**	**Time of Concentration:**					**0.031**
#2	5	3. Short grass pasture	32.41	35.00	107.99	4.550	0.006
#2	**5**	**Time of Concentration:**					**0.006**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	8.75	40.00	457.14	2.950	0.043
#3	**1**	**Time of Concentration:**					**0.043**

Pond 013
25-Year 24-Hour Storm Event

Emergency Spillway Demonstration and Constant 1000 gpm Flow

Tony Tennyson

Tri-State Generation & Transmission Assoc., Inc.
1100 West 116th Avenue
Westminster, CO 80234

Phone: (970) 824-1232
Email: ttennyson@tristategt.org

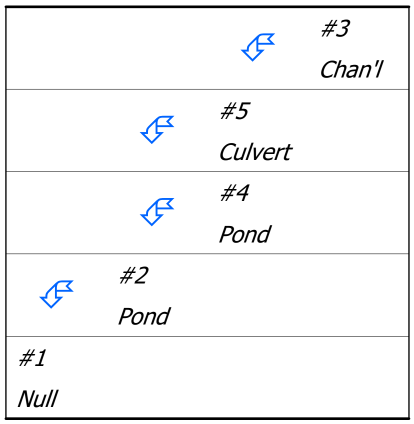
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	2.400 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Null Below Pond 013
Pond	#2	==>	#1	0.000	0.000	Pond 013
Channel	#3	==>	#5	0.000	0.000	Ditch C-9
Pond	#4	==>	#2	0.000	0.000	Continous flow 1000 gpm
Culvert	#5	==>	#2	0.000	0.000	Culvert C177 at Sta 0+25 in C-9 Ditch



Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3		6.710	6.710	6.43	0.49
#5		0.000	6.710	6.43	0.49
#4	In	100.000	100.000	64.25	4.60
	Out			2.23	4.60
#2	In	60.250	166.960	48.05	9.14
	Out			3.37	10.31
#1		0.000	166.960	3.37	10.31

Structure Detail:

Structure #3 (Vegetated Channel)

Ditch C-9

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.00	2.0:1	2.0:1	3.2	D, B	0.30			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	6.43 cfs		6.43 cfs	
Depth:	0.57 ft	0.87 ft	1.02 ft	1.32 ft
Top Width:	5.29 ft	6.49 ft	7.08 ft	8.28 ft
Velocity:	2.70 fps		1.25 fps	
X-Section Area:	2.38 sq ft		5.14 sq ft	
Hydraulic Radius:	0.427 ft		0.680 ft	
Froude Number:	0.71		0.26	
Roughness Coefficient:	0.0558		0.1647	

Structure #5 (Culvert)

Culvert C177 at Sta 0+25 in C-9 Ditch

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
20.00	2.50	0.0140	1.50	1.00	0.90

Culvert Results:

Design Discharge = 6.43 cfs

Minimum pipe diameter: 1 - 21 inch pipe(s) required

Structure #4 (Pond)

Continous flow 1000 gpm

Pond Inputs:

Initial Pool Elev:	90.01 ft
Initial Pool:	0.00 ac-ft

Pond Results:

Peak Elevation:	97.53 ft
Dewater Time:	0.04 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		
90.01	0.051	0.001	0.000		
90.50	0.077	0.032	2.228		
91.00	0.110	0.078	2.228		
91.50	0.147	0.142	2.228		
92.00	0.190	0.226	2.228		
92.50	0.224	0.330	2.228		
93.00	0.260	0.450	2.228		
93.50	0.303	0.591	2.228		
94.00	0.350	0.754	2.228		
94.50	0.394	0.940	2.228		
95.00	0.440	1.148	2.228		
95.21	0.461	1.243	2.228		
95.50	0.489	1.381	2.228		
96.00	0.540	1.638	2.228		
96.50	0.594	1.921	2.228		
97.00	0.650	2.232	2.228		
97.50	0.704	2.571	2.228		
97.53	0.708	2.594	2.228	1.05	Peak Stage
98.00	0.760	2.937	2.228		
98.50	0.819	3.331	2.228		
99.00	0.880	3.756	2.228		
99.50	0.949	4.213	2.228		
100.00	1.020	4.705	2.228		
100.50	1.127	5.242	2.228		
101.00	1.240	5.833	2.228		
101.50	1.319	6.473	2.228		
102.00	1.400	7.153	2.228		

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
102.50	1.498	7.877	2.228	
103.00	1.600	8.651	2.228	

Detailed Discharge Table

Elevation (ft)	User-input discharge (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
90.01	0.000	0.000
90.50	2.228	2.228
91.00	2.228	2.228
91.50	2.228	2.228
92.00	2.228	2.228
92.50	2.228	2.228
93.00	2.228	2.228
93.50	2.228	2.228
94.00	2.228	2.228
94.50	2.228	2.228
95.00	2.228	2.228
95.21	2.228	2.228
95.50	2.228	2.228
96.00	2.228	2.228
96.50	2.228	2.228
97.00	2.228	2.228
97.50	2.228	2.228
98.00	2.228	2.228
98.50	2.228	2.228
99.00	2.228	2.228
99.50	2.228	2.228
100.00	2.228	2.228
100.50	2.228	2.228
101.00	2.228	2.228
101.50	2.228	2.228
102.00	2.228	2.228
102.50	2.228	2.228
103.00	2.228	2.228

Structure #2 (Pond)

Pond 013

Pond Inputs:

Initial Pool Elev:	5,553.43 ft
Initial Pool:	3.72 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
24.00	5.50	24.00	100.00	3.40	0.0240	5,555.00	2

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
18.00	20.00	3.40	0.0240	5,557.00	0.90	0.00

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
18.00	20.00	3.40	0.0240	5,557.00	0.90	0.00

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
18.00	20.00	3.40	0.0240	5,557.00	0.90	0.00

Pond Results:

Peak Elevation:	5,555.01 ft
Dewater Time:	1.25 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,549.00	0.356	0.000	0.000		
5,549.50	0.440	0.199	0.000		
5,550.00	0.533	0.441	0.000		
5,550.50	0.658	0.739	0.000		
5,551.00	0.796	1.102	0.000		
5,551.50	0.944	1.536	0.000		
5,552.00	1.105	2.048	0.000		Low hole SPW #1
5,552.50	1.148	2.612	1.337	5.10*	
5,553.00	1.191	3.196	1.891	3.74*	
5,553.43	1.228	3.717	2.261	3.05	
5,553.50	1.234	3.803	2.316	0.45	
5,554.00	1.276	4.430	2.674	3.05	
5,554.50	1.319	5.079	2.990	5.10	
5,555.00	1.363	5.750	3.275	9.10	Spillway #1
5,555.01	1.366	5.768	3.368	0.40	Peak Stage
5,555.50	1.410	6.443	6.886		
5,556.00	1.457	7.160	15.127		
5,556.50	1.499	7.899	18.526		
5,557.00	1.541	8.659	21.392		Spillway #2 Spillway #3 Spillway #4
5,557.50	1.584	9.440	27.251		
5,558.00	1.627	10.243	35.625		
5,558.50	1.670	11.067	45.621		
5,559.00	1.714	11.913	55.528		
5,559.50	1.759	12.781	63.505		
5,560.00	1.805	13.672	70.343		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Straight Pipe (cfs)	Straight Pipe (cfs)	Straight Pipe (cfs)	Combined Total Discharge (cfs)
5,549.00	0.000	0.000	0.000	0.000	0.000
5,549.50	0.000	0.000	0.000	0.000	0.000
5,550.00	0.000	0.000	0.000	0.000	0.000
5,550.50	0.000	0.000	0.000	0.000	0.000
5,551.00	0.000	0.000	0.000	0.000	0.000

Elevation (ft)	Perf. Riser (cfs)	Straight Pipe (cfs)	Straight Pipe (cfs)	Straight Pipe (cfs)	Combined Total Discharge (cfs)
5,551.50	0.000	0.000	0.000	0.000	0.000
5,552.00	6.00>0.000	0.000	0.000	0.000	0.000
5,552.50	1.337	0.000	0.000	0.000	1.337
5,553.00	1.891	0.000	0.000	0.000	1.891
5,553.43	2.261	0.000	0.000	0.000	2.261
5,553.50	2.316	0.000	0.000	0.000	2.316
5,554.00	2.674	0.000	0.000	0.000	2.674
5,554.50	2.990	0.000	0.000	0.000	2.990
5,555.00	3.275	0.000	0.000	0.000	3.275
5,555.50	6.886	0.000	0.000	0.000	6.886
5,556.00	15.127	0.000	0.000	0.000	15.127
5,556.50	18.526	0.000	0.000	0.000	18.526
5,557.00	21.392	0.000	0.000	0.000	21.392
5,557.50	23.917	(3)>1.111	(3)>1.111	(3)>1.111	27.251
5,558.00	26.200	(3)>3.142	(3)>3.142	(3)>3.142	35.625
5,558.50	28.299	(3)>5.774	(3)>5.774	(3)>5.774	45.621
5,559.00	30.253	(5)>8.425	(5)>8.425	(5)>8.425	55.528
5,559.50	32.089	(5)>10.472	(5)>10.472	(5)>10.472	63.505
5,560.00	33.824	(5)>12.173	(5)>12.173	(5)>12.173	70.343

Structure #1 (Null)

Null Below Pond 013

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	5.950	0.043	0.000	0.000	83.000	M	6.41	0.486
	2	0.760	0.000	0.000	0.000	57.000	M	0.02	0.001
	Σ	**6.710**						**6.43**	**0.486**
#5	Σ	**6.710**						**6.43**	**0.486**
#4	1	100.000	0.000	0.000	0.000	74.000	M	64.25	4.601
	Σ	**100.000**						**64.25**	**4.601**
#2	1	30.900	0.291	0.000	0.000	83.000	M	18.77	2.017
	2	7.110	0.118	0.000	0.000	83.000	M	7.66	0.580
	3	17.760	0.174	0.000	0.000	83.000	M	12.42	1.178
	4	3.340	0.031	0.000	0.000	83.000	M	3.60	0.273
	5	1.140	0.006	0.000	0.000	57.000	M	0.02	0.004
	Σ	**166.960**						**48.05**	**9.139**
#1	Σ	**166.960**						**3.37**	**10.312**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	5. Nearly bare and untilled, and alluvial valley fans	2.32	37.00	1,594.82	1.520	0.291
#2	**1**	**Time of Concentration:**					**0.291**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	3.68	30.00	815.21	1.910	0.118
#2	**2**	**Time of Concentration:**					**0.118**
#2	3	5. Nearly bare and untilled, and alluvial valley fans	2.85	30.00	1,052.63	1.680	0.174
#2	**3**	**Time of Concentration:**					**0.174**
#2	4	5. Nearly bare and untilled, and alluvial valley fans	7.86	25.00	318.06	2.800	0.031
#2	**4**	**Time of Concentration:**					**0.031**
#2	5	3. Short grass pasture	32.41	35.00	107.99	4.550	0.006
#2	**5**	**Time of Concentration:**					**0.006**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	8.75	40.00	457.14	2.950	0.043
#3	**1**	**Time of Concentration:**					**0.043**